Frontloaded Academic Support: Supplemental Instruction in Two-Year Colleges

Introduction

The first year of college has always presented challenges to both students and institutions. For students, it is one of life's most critical transitions. In fact, the most critical period for first time students is during the initial six weeks of their first semester in college. This is the time most likely for the student to drop out (Blanc, DeBuhr, and Martin, 1983; Noel, Levitz, Saluri, and Associates, 1985). The student attrition rate of nearly 50 percent for the first year college student is a national trend among two-year institutions with open admission policies (American College Testing Program, 1993). This attrition rate has increased over the past decade (Tinto, 1993). For students who begin their academic careers at two-year colleges, the transfer rate to senior institutions is often disappointing. For example, the transfer rate for minority students in California community colleges is between five and 10 percent. Nearly 90 percent of minority students enrolled in college in California are in community colleges (Conciatore, 1991, p. 24).

Most institutions are faced with severe budget constraints and limited flexibility in assigning personnel to student retention activities. For these reasons, institutions have to be very careful in assigning limited resources to meet their needs. Research suggests it is best to concentrate academic support activities during the first year for college students (Upcraft, Gardner, and Associates, 1989). An expression to describe this strategy is called "frontloading" (Noel et al., 1985).

There are many academic and social differences between the high school and college (Weinstein, Johnson, Malloch, Ridley, and Schultz, 1988). It is no surprise that first year students are the most prone to withdraw since they have to contend with significant changes. Watkins (1990) attributes low transfer rates and high drop out rates to the poor academic and economic background of the typical community college student. Some call attention to the large proportion of so-called "non-traditional"

students who populate two-year college campuses. While these older students face the common academic challenges experienced by their younger counterparts, these problems are exacerbated by their multiple roles of student, worker, parent and/or spouse (Woodard, Brown, and Suddick, 1991). Others point out that the American higher education system is designed to sort and separate students through its complicated system of differing admission processes, levels of tuition and fees, examination of previous academic achievement, and attainment of certain scores on national standardized examinations. More capable students (both financially and educationally) attend the selective colleges and universities. Less capable students attend community colleges (Deegan, Tillery, and Associates, 1985).

Tinto (1993) found that four clusters of events tend to be experienced by college students before they drop out: difficulty in adjusting to the college environment; experiencing academic and social difficulty; suffering from incongruence between the student's expectations and the college's demands; and a feeling of social isolation. These clusters of events are often acutely felt during the first year. Tinto's model continues to be studied and validated by other researchers (Christie and Dinham, 1991).

Effective models of retention stress the need for students to be integrated into the academic and social dimensions of the college community (Tinto, 1993; Tinto in Spann, 1990). These connections need to be established during the first weeks of their first year of college. This interpersonal support system is important for all first year students, despite their background and experience (Upcraft et al., 1989).

Two-year colleges have set up many services to help their students. The Freshman Year Experience (FYE) movement has been strongly embraced by two-year colleges (Fidler and Fidler, 1991). Over 70 percent of such institutions offer some version of the FYE seminar for their students (Barefoot, 1992). A recent national research study detailed the percentage of two-year colleges that offered the following

academic support activities: developmental education courses, 95.6 percent; academic tutoring, 70 percent; and counseling and advising, 73 percent (Boylan, Bonham, and Bliss, 1994).

Overview of Supplemental Instruction (SI)

Supplemental Instruction (SI) is a student academic assistance program that increases academic performance and retention through its use of collaborative learning strategies. The SI program targets traditionally difficulty academic courses, those that typically have 30 percent or higher rate of D or F final course grades and/or withdrawals, and provides regularly scheduled, out-of-class, peer-facilitated sessions that offer students an opportunity to discuss and process course information (Martin and others, 1977).

Assistance begins in the first week of the term. The SI leader introduces the program during the first class session and surveys the students to establish a schedule for the SI sessions. Attendance is voluntary. Students of varying abilities participate, and no effort is made to segregate students based on academic ability. Many underprepared students who might otherwise avoid seeking assistance will participate in SI, since it is not perceived to be remediation and there is no stigma attached. Such stigmas can cause motivation problems for developmental students (Somers, 1988). SI is a cost-effective program both in comparison with one-on-one tutoring programs and increasing student persistence/graduation rates (Martin et al., 1993).

The SI program at Sinclair Community College (Dayton, OH) has shown its cost effectiveness in comparison with individual tutoring since 1991. According to Anna Mays, Director of Educational Support Services and the campus SI supervisor, the cost effectiveness of the program was critical in winning administrative support. Approximately 800 to 1,000 students each academic term attend SI sessions in five to six classes. Some classes include Introduction to Accounting, Anatomy and Physiology,

General Chemistry, and College Algebra. The courses share common characteristics: high percentage of D and F final course grades and withdrawals, required course for certain college majors; and the course often serves as "gateway" class that must be passed before the student can take additional courses in the sequence.

The most prevalent institutional type to implement SI has been public two-year colleges. Since 1982, nearly 1,000 faculty and staff from 517 post-secondary institutions have received training to implement SI on their campus. A breakdown of these 517 institutions follows: two-year public, 37.5 percent; private two-year colleges, 1.5 percent; four-year public, 34.0 percent; and four-year private, 27.0 percent.

There are several reasons why SI is well suited to help two-year students. Recognizing that time schedules of two-year college students are often very busy, SI helps students to be more efficient since it provides managed study time. Students can study more efficiently and effectively in a shorter period than if the student attempted to study alone. Naturally SI does not replace all individual study time. However, it can become an important part of the student's weekly study activities. A second reason is that SI provides effective academic support in difficult classes taken by students during their first year. This support is especially important for older or returning students who have been out of high school for a long period of time. Another reason is that participation in SI provides a mentoring relationship for the new student. The student can observe the successful learning strategies of the SI leader who is facilitating the SI sessions. A fourth reason is that SI helps to form learning communities among two-year students who generally are isolated from one another. While some unannounced small groups that involve a few students are haphazardly formed in a class, the SI model allows the institution to provide the service intentionally in targeted classes. Also, all students in the class are invited to participate in the sessions.

Lincoln Land Community College (Springfield, IL) offers SI in six classes each academic term. The program was begun in 1988. Some of those classes include

Microbiology, Basic Chemistry I and II, World History, and Introduction to Economics. Marian England, Assistant Director of the Study Skills Center and Campus SI Supervisor, finds that the collaborative learning process is especially helpful in the sciences. She reports that several of college instructors in math and science have been influenced by the SI program and its use of peer collaborative learning. Since SI is not available in their classes, the instructors help organize their students into teams that meet outside class. On a periodic basis the instructors visit the work teams to monitor their progress.

Jean Jubelirer, campus SI Coordinator for Milwaukee Area Technical College (WI), also finds the collaborative nature of SI very powerful. The SI program started with two classes in 1989 and now operates in 13 classes each term. The program serves over 1,000 students each year. The classes come from many areas: vocational education, science, social science, and business. Jubelirer says that SI helps to form learning communities composed of the SI leader, participating students, and the classroom instructor. Strong bonds are formed among all three. Beyond quantifiable results of increased course grades and persistence, students frequently comment on the impact of the SI program with them personally. Faculty members often voice their appreciation of the support for their classes as SI leaders help students to process and learn the material presented in the class lectures.

SI as a Follow-up to FYE. Supplemental Instruction is an excellent follow up activity for students who have participated in first year experience programs. SI provides a supportive environment for the immediate application and use of study strategies that were discussed or demonstrated during those programs.

A challenge for first year student programs that are conducted before the beginning of the academic term is that they often rely on lectures concerning study strategies. These instructional sessions are therefore isolated from the actual content material in college courses. Students often feel frustrated when faced with abstract

lectures concerning study skill instruction that is dissociated from college content material. Rather than seeing the need for such instruction, many students associate study skill strategy review as appropriate for "other students," those who need remedial or developmental assistance. Students perceive a vested interest in study skill strategies when the skills are directly applied to content courses that the students are currently taking (Martin, Blanc, DeBuhr, Alderman, Garland, and Lewis, 1983). Faced with an impending exam, students are receptive when they might otherwise be uninterested.

Focus on High-risk Courses Instead of High-risk Students. SI avoids the remedial stigma often attached to traditional academic assistance programs, since it does not identify *high-risk students* but identifies *high-risk classes*. SI is open to all students in the targeted course; therefore, prescreening of students is unnecessary. Since the SI program begins the first week of the academic term, the program provides academic assistance during the critical initial six-week period of class before many students face their first major examination. Attrition is highest during this period (Blanc et al., 1983; Noel et al., 1985).

Other researchers (Christie and Dinham, 1991; Martin et al., 1983; Tinto, 1993) have concluded that it is difficult to rely solely upon the analysis of high school grades and standardized college entrance examination to accurately identify all students who will drop out or withdraw from college. Less than 25 percent of all students who drop out of college due so because the institution has academically dismissed them (Tinto, 1993). Many leave the institution due to extreme difficulty and frustration in high risk courses.

Historically difficult or "high-risk" courses often share the following characteristics: large amounts of weekly readings from both difficult textbooks and secondary library reference works, infrequent examinations that focus on higher cognitive levels of Bloom's taxonomy, voluntary and unrecorded class attendance, and large classes in

which each student has little opportunity for interaction with the professor or the other students. SI is often attached to traditionally difficult, high-risk courses that serve first and second-year students. Several institutions report the successful use of SI with students in graduate and professional schools (Bridgham and Scarborough, 1992; Martin et al., 1993; Martin, 1980). However, each institution may develop its own definition of "high-risk courses."

Such a designation of "high-risk" for a course makes no prejudicial comment about the professor or the students. It is a numerical calculation that suggests many students have difficulty in meeting academic requirements for the class. Rather than blaming the students or the professor, the designation suggests that additional academic support is needed for students to raise their level of academic performance to meet the level deemed appropriate by the classroom professor. In recent years, the popular and professional literature has been replete with extensive discussions about who is at fault for the perceived lower quality of student academic achievement. SI bypasses this issue and provides a practical solution that helps students meet the professor's level of expectation.

Linn-Benton Community College (Albany, OR) has focused on high risk classes in science. Their SI program was started in 1986. The SI program is directed by May Garland who is also the Coordinator of the Learning Center. Before her appointment to Linn-Benton, Garland helped direct the national dissemination of SI at the University of Missouri-Kansas City. Some classes targeted for SI support are Anatomy and Physiology, Psychology, and General Chemistry. The Chemistry classes were targeted not only because they were academically challenging, but also since they were gateway classes for nursing students. It appears that the collaborative learning afforded by SI has been critical for the persistence of these students. There is also strong support from the faculty members in encouraging all students, no matter their test scores, to attend the SI sessions.

Key SI Program Personnel. There are key persons involved with SI on each campus--the SI leaders, the SI supervisor, and the course instructors. Each plays an important role in creating the environment that allows the SI program to flourish.

The SI leader is a student who has successfully completed the targeted class or a comparable course. It is ideal if the student has taken the course from the same instructor for whom he or she is now providing SI assistance. The SI leader is trained in proactive learning and study strategies and operates as a "model student," attending all course lectures, taking notes, and reading all assigned materials. The SI leader conducts three or more out-of-class SI sessions per week during which he/she integrates "how to learn" with "what to learn" (Martin et al., 1983).

Institutions select a variety of means to compensate the SI leader. Most frequently, they are paid an hourly wage or receive a monthly stipend. Maple Woods Community College (Kansas City, MO) found a creative solution. Dr. Deborah Craig-Claar, Associate Dean of Instruction, worked with the financial aid advisor to obtain partial fee waivers for the SI leaders. Dr. Craig-Claar reports that a key to the success of their SI program has been the flexibility of scheduling the SI sessions when students want to attend (Craig-Claar, 1994).

The SI leader is a facilitator, not a mini professor. The role of the leader is to provide structure to the study session, not relecture or introduce new material. The SI leader should be a "model student" who shows how successful students think about and process course content. He or she facilitates a process of collaborative learning, an important strategy since it helps students to empower themselves rather than remain dependent as they might in traditional tutoring. Research suggests that tutoring relationships do not always promote transfer of needed academic skills (Blanc et al., 1983; Dimon, 1988; Keimig, 1983; Martin, et al., 1993, 1983, 1981, 1980, 1977; Maxwell, 1990).

A central responsibility of the SI leader is to integrate study skills with the course content. As someone who has performed well in the course, the SI leader has displayed mastery of the course material. However, it is important for the SI leader to share his/her learning strategies with the other students in the SI sessions. If the students only learn content material and not the underlying study strategies, they will have a high probability of experiencing academic difficulty in succeeding courses.

Besides the benefits for SI participants, there are intangible benefits for the SI leader. Victoria Anderson, Director of the Learning Assistance Center at Highland Community College (Freeport, IL) relates that many of her SI leaders are using their time as a preteaching experience. Frequent classes for SI are Physical Geography and Introduction to Biology. Anderson believes that the instructors for those courses influence several students each year to consider teaching careers. Often these students are selected as SI leaders. While not performing as a teacher, but as a facilitator, the SI role allows the students to spend more time with the instructors and with the subject matter. Anderson has not had difficulty in recruiting candidates for the SI leader positions.

Another key person with the SI program is the faculty member. SI is only offered in connection with classes that have the full support of the classroom instructor. Instructors can choose their level of involvement with the SI program. At a minimum, the instructor makes an announcement at the beginning of the academic term endorsing the SI program and encouraging the participation of all students. Some instructors spend a few minutes each week with the SI leader reviewing SI session plans. Increasing levels of involvement could lead to the instructor helping the SI leader prepare mock practice exams or practice problems.

At Anne Arundel Community College (Arnold, MD) the SI program has been active since 1986 and is guided by Dr. Rosemary Wolfe, Chair of the Education Department. The SI program offers service in seven or eight classes each term (Wolfe,

1987). Classes include: Calculus I & II, Introduction to Biology, Introduction to Chemistry, Accounting, and some foreign language classes. Some faculty members serve as SI supervisors. Faculty have several options to earn promotion credit for increased salary. Some choose to attend graduate school. Others are allowed to earn "professional development credit." Faculty who choose this option and are approved by the SI program help supervise the SI leaders (Wolfe, 1990). Wolfe received a grant from the Fund for the Improvement of Post-Secondary Education to initially implement this activity. Since the conclusion of the grant, the institution has continued the mentor faculty program.

An important feature of this program is that the faculty members supervise SI leaders in areas outside their content specialty. The faculty members focus on general learning skills, and not on critiquing the content of the instructor for which the SI is being offered. These faculty mentors attend classes and SI sessions with student SI leaders for the first four weeks of the term; these teachers become students in the course, attending class and taking notes with the SI leader. Before the SI review sessions, these master teachers, as skills specialists, work with the SI leaders, the content specialists. They prepare materials and plan activities. Following SI sessions, mentors offer constructive comments.

As students in a class that is outside their discipline, these faculty mentors have the opportunity to observe and learn different approaching and teaching techniques. They may also become a non-threatening resource for integrating study skills into course lectures, readings, and assignments.

Integration of What to Learn with How to Learn. The integration of study skills with the course content is a key difference between SI and other forms of collaborative learning. It is not just that students are working together. It is the planned integration and practice of study strategies that sets SI apart. We believe that by combining ***what to learn*** with ***how to learn it***, students can develop both content competency and

transferable academic skills. SI sessions capitalize on the use of the "teachable moment" to apply and model learning strategies with the course material.

Supplemental Instruction provides many opportunities to address study skills within the content of the course. Research has shown that teaching study skills in isolation from content has little impact on the students' academic performance (Dimon, 1988; Keimig, 1983; Stahl, Simpson, and Hayes, 1992). While students can be taught elaborate note-taking and text-reading strategies, these skills are not necessarily put to use in courses that they subsequently take. Also, it is likely that different classes will require different note-taking styles and a science text is used differently from a social science text. As SI leaders model appropriate questioning and reasoning, students begin to internalize aspects of thinking strategies that will carry over into their individual and group study.

SI Facilitates the Development of Community and Support. Many education leaders decry the lack of significant interpersonal relationships among students who attend college. As more returning adult students attend college, the institution continues to become more heterogeneous in nature. This is especially critical for two-year colleges. The institution must take proactive steps to provide an environment for development of community with today's students. Active learning, smaller classes, more interactions between the professor and students are suggested as strategies to develop community (Tobias, 1992). In Astin's latest study on the impact of college, he stated, " . . . [T]he student's peer group is the simply most potent source on influence on growth and development during the undergraduate years" (Astin, 1993, p. 398).

SI brings students together in small groups for class study sessions. For some of these students, this is their only time to interact with other classmates. With competing time commitments of work, family and commuting, many students no longer have the luxury of remaining on campus without a specific meeting or purpose. Students develop a sense of community with each other during SI sessions.

To help foster more collaborative learning and peer support at Onondaga Community College (Syracuse, NY), they have created what they call "SI-Plus." Barbara Risser is an associate professor of English and the campus SI coordinator. Risser says that SI-Plus provides an introduction to the study group experience for students who have just completed several developmental education courses and are just beginning to enroll in college level coursework. The classes that have SI-Plus often do not meet the criteria of being designated as "high risk" by the SI model. SI-Plus is meant as a bridge to help students adjust to college level work. The regular SI program is reserved for the high risk courses. Some students in succeeding semesters establish their own independent study groups if SI or SI-Plus is not available in the class.

There has been particular concern with student persistence in mathematics, science and engineering for all student subpopulations, particularly females and non-Caucasians. Some researchers have found a positive correlation between persistence in science major coursework and involvement in study groups outside class for female students (Shlipak, 1988). Researchers suggest that increased student involvement is an important strategy to help stem the drop out rate for all science and math students (Hilton and Lee, 1988). Light (1992) also cited the importance of small, student-organized study groups as a key for explaining why students enrolling in additional science courses.

Glendale Community College (Glendale, CA) has reported good success with SI in calculus courses. Some student comments are illustrative of the benefits of the SI sessions. "What I really liked about the SI was that if I had any questions, Dr. Kolpas or the other helpers didn't tell us the answer. Instead, they let us think about the problem, set it up, and solve it ourselves. I also liked the one-on-one help and the friends I made." "Having more opinions and minds to work a problem helped a lot. The groups discussed problems from many different points of view." (Allen, Kolpas, and Stathis, 1992, p. 9).

Examples of SI Session Activities. The SI leader can mentor the students in using strategies that the leader previously found helpful with the course material. This is why it is so critical that the SI leader attends class with the students. The students need specific assistance with the day's reading material and lecture notes besides appropriate use of study skill strategies. SI activities can enhance both study skills and comprehension of the course content. It is generally not advisable to label these activities study skill instruction, but rather to weave skills into the context of the course material. SI leaders need to recognize the "teachable moment" and introduce or model the appropriate skills, tying them directly to the content review. Often these discussions last only a few minutes at most. Several examples of how this can be accomplished are noted here.

Processing lecture notes requires students to consider the adequacy of their own note-taking techniques. It quickly becomes evident to many of them that there may be a better method for recording what the professor said than the one they presently use. SI leader suggestions might include use of summary margin notebook paper (which has a wide left margin), recopying notes that are particularly difficult to decipher, writing potential test questions that can be used for reviewing the material in their notes, correlating notes with outside reading assignments, and highlighting notes when appropriate.

Students find that organizing and processing information during the SI session is a very beneficial experience. They see that course content is manageable and that with some work and mutual support, they can make sense out of even the most difficult material.

After each exam, the SI leader can guide the group in going over the questions that were particularly troublesome. This process reinforces the correct answers on the exam and gives the students a chance to examine how they interpreted the questions; how they derived the answers; and if they made an error, why they made it. Reviewing

the test will also help students to understand more thoroughly the kinds of questions the professor asks and to predict future test question more accurately.

The SI leader needs to be trained to make referrals to other campus resources. This referral role is especially important for the first year students since they may not yet have developed close relationships with an academic advisor or other campus personnel who also might make referrals.

If the textbook includes graphs, charts or diagrams, it is important that the students do not omit these aids from their study of the materials. Occasionally, when graphs are used extensively, it is appropriate to review how to read and interpret graphs, as well as review the material they contain.

Straight text reading efficiency can be enhanced through a procedure called "reciprocal questioning" (Martin and Blanc, 1984). In brief, a small section of the text is selected for silent reading. Then both the SI leader and the students take turns asking and answering questions. When students become active readers, as this procedure requires, they find that the time they must spend in re-reading material is greatly reduced because they comprehend more information during their initial reading.

Examination of text materials will also help students to discover cues that they can use in deciding what reading rate is correct for specific parts of the text. Sometimes, it is acceptable to skim quickly. Other parts of the text will require thorough reading, or re-reading.

At times during the term it will be helpful to direct the students' attention back to the course syllabus. From the syllabus students can anticipate the dates of future tests and the amount of material to be covered between tests. Some discussion can result that will include tips on time management.

SI as an Alternative to Mandatory Testing and Placement

Because most public two-year institutions have open admission policies, they attract large numbers of remedial or developmental students. While two-year colleges

have provided a variety of academic support services for their students (Barefoot, 1992; Boylan et al., 1994), the persistence and graduation rates for developmental students have been disappointing. In a national longitudinal study it was found that only 24.0 percent of developmental students were continuing to enroll in classes or had graduated from two-year institutions (Boylan and Bonham, 1992).

Dependent learners are in need of extensive assistance during the first year (Levitz and Noel, 1989). "The underprepared student is often one who may have the basic intellectual capacity but who has reached a point of impasse temporarily created by a mismatch between his or her knowledge base and the new information that he or she is expected to absorb on an independent basis" (Tomlinson, 1989, p. 20).

A characteristic of dependent learners is that they have yet to make the transition from what teachers in high school expect to what professors expect in college. The nature of the high school environment often helped these students to meet the minimum academic requirements at this level: daily homework; weekly examinations; daily class attendance; and social support from their family, friends or other social groups. Most of these characteristics are missing at the college level (Weinstein et al., 1988).

However, there ought to be alternatives to mandatory testing and placement in developmental education programs. Cohen and Brawer (1989) have stated this argument most succinctly. "Thus, the establishment and operation of segregated compensatory education programs become freighted with overtones or racism. Because requiring a literacy test for admission to college transfer programs tends to discriminate against members of the ethnic minorities, who may have been less well prepared in the lower schools. The compensatory programs take on the appearance of programs for the culturally different, giving rise to charges that reading tests are culturally biased and that writing tests discriminate unfairly against those who native language is other than English" (Cohen and Brawer, 1989, p. 248). Cohen and Brawer continue by stating that students who need additional academic support should be

mainstreamed in regular college credit courses if supplementary activities are available to support them. Cohen and Brawer conclude their argument in this area by observing that the unique open-door mission of community college requires that students not be denied access to programs of their choice.

Developmental students especially are in need of academic assistant that helps them develop independent learning skills. In SI, students have the opportunity to learn and use strategies until they master them. They need the structure of the SI sessions to observe and practice these skills. Once these students internalize and begin to use more efficient skills on their own, they are much less likely to drop out in succeeding semesters.

Data From Two-Year Public Colleges That Have Implemented SI

Research Design. The basic design of various quasi-experimental research studies compares performance of the voluntary treatment group (SI Participants) with the control group (Non-SI Participants). While not included with this article, other studies have controlled for motivation, prior academic achievement, and ethnicity (Martin et al., 1993). Dependent variables for this study is the final course grade. Lacking random assignment, the design does not meet the standards for experimental design. Results have, however, been replicated across many institutions, and results are analyzed longitudinally, both for UMKC and for other participating institutions (Blanc et al., 1983).

Population. Since 1982, faculty and staff from 183 public and private two-year institutions have received formal training to implement the SI model on their campus. The following tables were compiled from 59 selected two-year public institutions that met the following criteria: (1) their data collection procedures conformed to recommendations of the UMKC staff; (2) they transmitted their data for inclusion in a

timely fashion; (3) they included data from two-year public institutions from a geographically diverse area.

Only public two-year institutions were included in this study. Of the 496 two-year course reports in the national SI database that were available for analysis, 480 of the reports were from public institutions. While reports from the private two-year institutions were similar, the authors felt that the following studies should focus on the most prevalent institutional type in the data base.

Data Analysis. Standard statistical methods were used in analysis of the data comparing student outcomes. The requisite level of significance was set at $p < .05$ to conform with standard practice in educational research. Independent t-tests were selected as most appropriate for comparing final course grades, despite lack of universal standards for such grading and the obvious fact that grades may sometimes represent ordinal data and interval data in others. Chi square tests were used in comparing the percentages of A and B final course grades and the percentage of D and F final course grades and withdrawals.

Inasmuch as SI participation stands as the key independent variable in the study, careful attention was given to the definition of "participation." Setting a minimum level of attendance higher than "one" offered the possible advantage of teasing out the impact of repeated attendance. That minimum seemed most appropriate, however, since those who withdrew from the courses were counted as "unsuccessful enrollments." A higher minimum was through to interject bias in favor of SI by excluding as "SI participants" those students who withdrew from the course after participating ion one or a few SI sessions. Therefore, the minimum participation in a single SI session was deemed sufficient to classify a student as an "SI participant."

Academic Achievement for Two-Year Students Enrolled in SI Courses.

Table #1 presents data comparable to that collected by UMKC concerning two-year institutions from across the U.S. Differences were statistically significant in each instance with respect to both percent of unsuccessful enrollments and grade point average in targeted classes. In each instance, the difference favored the group that had participated in the SI program.

The data rarely showed more than a .5 grade point difference between SI participants and non-participants, and often this turned out to be the difference between low "C" and high "D."

Table #1
National SI Field Data: FY 1982-83 to 1992-93
(N=59 Two-Year Public Institutions; 480 Courses; 23,979 Students)

Student Grades	SI Participants	Non-SI Participants	p-value
Final Course Grade**	2.30	1.63	< 0.000
Percent A & B Final Course Grade*	50.58%	32.9%	< 0.007
Percent D, F & W Final Course Grade*	25.9%	46.25%	< 0.000

* Using chi-square test. ** Using independent t-test.

The survey of data from 59 two-year public institutions permit separating SI by academic discipline in Table #2. There were clear differences among disciplines, with technical/ vocational courses showing the highest percentage of honor grades and the lowest percentage of unsatisfactory enrollments. Other areas, like mathematics, typically have students who form a bi-modal distribution of math skills. Since math is not a prerequisite for a variety of college majors, students may be satisfied with lower grades in this subject area. Therefore, it is not surprising that this area has a higher percentage of unsatisfactory enrollments. Nonetheless, performance in all measured categories favored SI participants.

Table #2
National SI Data: FY 1982-83 to 1992-93
(N=59 Two-Year Public Institutions; 480 Courses; 23,979 Students)
Data Separated by Broad Academic Disciplines

Types of Courses		Percent A & B**	Percent D, F & W**	Final Course Grade*
All Courses	SI	50.58%	25.9%	2.30
N = 480	Non-SI	32.9%	46.25%	1.63
	p-value	< 0.000	<0.007	< 0.000
Business	SI	51.23%	26.7%	2.27
N = 87	Non-SI	34.02%	47.8%	1.49
	p-value	n.s.	< 0.001	< 0.000
Health Science	SI	62.88%	20.56%	2.66
N = 22	Non-SI	50.79%	27.01%	2.07
	p-value	n.s.	n.s.	< 0.023
Mathematics	SI	42.19%	37.57%	1.9
N = 82	Non-SI	32.32%	53.14%	1.3
	p-value	n.s.	< 0.001	< 0.000
Natural Science	SI	50.43%	21.47%	2.39
N = 140	Non-SI	34.99%	38.43%	1.7
	p-value	< 0.005	< 0.001	< 0.000
Social Science/	SI	52.19%	22.36%	2.39
Humanities	Non-SI	32.84%	42.31%	1.64
N = 104	p-value	< 0.001	< 0.001	< 0.000
Technical/	SI	63.67%	20.81%	2.53
Vocational	Non-SI	41.10%	43.44%	1.78
N = 27	p-value	n.s.	n.s.	< 0.001

* Using independent t-test. ** Using chi-square test.
n.s. = not statistically significant.

Table #3 illustrates the difficulty inherent in compiling data on student performance by type of course, as suggested above. Differences must be of considerable magnitude to be deemed statistically significant. Thus, although final course grade differences are statistically significant across academic courses and departments, differences in the categorical variable of honor grades and unsatisfactory outcomes are not significant sometimes.

Table #3
National SI Field Data: FY 1982-83 to 1992-93
(N=59 Two-Year Public Institutions; 480 Courses; 23,979 Students)
Data Separated by Academic Departments or Individual Courses

Types of Courses		Percent A & B**	Percent D, F, & W**	Final Course Grade*
All Courses	SI	50.58%	25.9%	2.30
N = 480	Non-SI	32.9%	46.25%	1.63
	p-value	< 0.000	< 0.007	< 0.000
Accounting	SI	49.1%	29.2%	2.24
N = 69	Non-SI	35.16%	48.86%	1.49
	p-value	n.s.	< 0.001	< 0.000

Types of Courses		Percent A & B**	Percent D, F, & W**	Final Course Grade*
Algebra	SI	41.47%	39.34%	1.84
N = 49	Non-SI	33.27%	53.36%	1.24
	p-value	< 0.01	< 0.001	< 0.000
Anatomy/	SI	56.85%	18.46%	2.58
Physiology	Non-SI	43.00%	32.9%	1.90
N = 27	p-value	n.s.	n.s.	< 0.000
Biology	SI	47.94%	25.26%	2.35
N = 45	Non-SI	31.19%	43.10%	1.67
	p-value	< 0.005	< 0.001	< 0.000
Calculus	SI	44.37%	28.75%	2.09
N = 9	Non-SI	29.78%	45.39%	1.58
	p-value	n.s.	n.s.	< 0.029
Chemistry	SI	51.19%	17.13%	2.44
N = 52	Non-SI	34.89%	37.02%	1.77
	p-value	n.s.	< 0.001	< 0.000
Economics	SI	44.76%	26.76%	2.13
N = 28	Non-SI	27.12%	50.50%	1.51
	p-value	n.s.	< 0.01	< 0.001
Engineering	SI	66.17%	19.40%	2.57
N = 19	Non-SI	39.16%	45.83%	1.66
	p-value	n.s.	n.s.	< 0.001
English	SI	37.27%	48.18%	1.99
N = 9	Non-SI	17.82%	58.41%	1.38
	p-value	< 0.025	< 0.02	< 0.014
History	SI	53.09%	22.8%	2.50
N = 19	Non-SI	22.39%	55.2%	1.33
	p-value	< 0.001	n.s.	< 0.000
Political Science	SI	46.96%	28.28%	2.29
N = 13	Non-SI	32.76%	40.87%	1.57
	p-value	< 0.001	n.s.	< 0.001
Psychology	SI	54.62%	18.34%	2.53
N = 32	Non-SI	37.82%	36.66%	1.90
	p-value	< 0.005	< 0.001	< 0.000

* Using independent t-test. ** Using chi-square test.
n.s. = not statistically significant.

Interpretation and Discussion of Results. SI research methodology presented here and with other published studies (Martin et al., 1993; Blanc et al. 1983) has accounted for the students' profile (e.g., previous levels of academic achievement, standardized test scores, high school rank, ethnicity, motivation level) when comparing SI participants and non-SI participants. Research suggests that there is no significant difference between the two groups in terms of what they bring to the classroom and their participation percentage with SI. Final course grades, reenrollment rates and

graduation rates are used as the evaluation criteria for effectiveness. With respect to each dependent variable, the differences favored the SI group.

While success varies among and between SI programs, we are not in possession of data that would suggest that SI has any major limitations. However, we do know that SI is more difficult in content areas where pre-requisite skills are a key variable. For example, if students do not remember any algebra, they will have a particularly difficult time in chemistry. SI can be and is effective in these areas, however. It just takes more time planning by the SI leader. The clearest evidence we have every had of failure was in a college where SI was attached to remedial classes. Students refused to attend; the course was not considered demanding or high risk by students. After that experience, we made a point of stressing to adopting institutions that they choose courses that were considered by students and faculty to be high risk.

SI has not been effective for students who cannot read, take lecture notes, write, or study at the high school level. Writing includes note taking and expository writing on essay tests. Thus, SI is most effective in non-remedial settings. Currently, we are piloting an adaption of SI, Video-based SI (VSI), which helps students compensate for severe underpreparation in reading and writing. The students participating in the pilot tests include inner-city minority high school students, minority community college students, college student athletes, and academic probationary college students. The preliminary results appear promising (Martin and Blanc, In press).

We have found that the SI model needs to be slightly modified in courses that are problem based and involve practice for mastery. In those circumstances, SI sessions need to be more frequent and sometimes longer. For example, a three credit-hour accounting course where practicing problems are crucial would need to have SI meet often enough so that every type of problem could be reviewed. A similar example would be a calculus class. SI would have to afford adequate time for modeling and practice.

Frequently, offering SI more times a week and carefully structuring the SI sessions achieves this goal.

Conclusion

It has been nearly two decades since Supplemental Instruction first appeared in higher education. After starting at the University of Missouri-Kansas City in 1973, SI has been implemented at a variety of institutions across the United States and around the world. Borrowing ideas from developmental psychology, SI has attempted to encourage students to become actively involved in their own learning. By integrating appropriate study skills with the review of the course content, students begin to understand how to use the learning strategies they have heard about from teachers and advisors. As new educational theories and practices have surfaced, the SI model has been adapted to incorporate the best in educational research.

In collaboration with a variety of other first year experience programs, SI can provide an important asset for increasing student effectiveness, retention and satisfaction at two-year colleges. It provides an environment to review, practice and make application of study strategies presented during orientation programs. SI leaders can make referrals to other campus resources when needed. Finally, SI sessions can contribute to development of the student in terms of interpersonal skills, multi-cultural education, and self-esteem. SI provides another way to "front-load" the first year experience of students.

References

Allen, M., Kolpas, S., and Stathis, P. (1992, October). "Supplemental Instruction in Calculus [SIC] at a community college," Collaborative Learning Exchange, 8-9.

American College Testing Program. (1993). ACT Institutional Data File, 1993. Iowa City, IA.

Astin, A. W. (1993). What matters in college: Four critical years revisited. San Francisco: Jossey-Bass, Publishers.

Barefoot, B. (1992). "Helping first-year students climb the academic ladder: Report of a national survey on freshman seminar programming in American higher education." Unpublished doctoral dissertation. College of William and Mary, Williamsburg, VA.

Blanc, R.A., DeBuhr, L., and Martin, D.C. (1983). "Breaking the Attrition Cycle: The Effects of Supplemental Instruction on Undergraduate Performance and Attrition." Journal of Higher Education, 54 (1), 80-89.

Boylan, H. R., Bonham, B. S., and Bliss, L. B. (1994). "Characteristic components of developmental programs," Review of Research in Developmental Education, 11 (1), 1-4.

Boylan, H. R., Bonham, B. S. (1992). "The impact of developmental education programs," Review of Research in Developmental Education, 9 (5), 1-4.

Bridgham, R.G., and Scarborough, S. (1992). "Effects of Supplemental Instruction in Selected Medical School Science Courses." Academic Medicine RIME Supplement, 67 (10), 569-571.

Christie, N.G., and Dinham, S.M. (1991, July/August). "Institutional and external influences on social integration in the freshman year," Journal of Higher Education, 62 (4), 412-436.

Cohen, A. M., Brawer, F. B. (1989). The American Community College. San Francisco: Jossey-Bass Publishers, Second Edition.

Conciatore, J. (1991, December 19). "From dialogue to collaboration: Educators, business leaders, policymakers discuss problems of underprepared students in community colleges," Black Issues in Higher Education. 8 (21), 18-21.

Craig-Claar, D. (1994, Summer). "Starting SI at Maple Woods Community College," SI News, 1-2.

Deegan, W.L., Tillery, D., and Associates. (1985). Renewing the American community college. San Francisco: Jossey-Bass Publishers.

Dimon, M. (1988). "Why Adjunct Courses Work." Journal of College Reading and Learning, 21, 33-40.

Fidler, P.P., and Fidler, D.S. (1991). First national survey on freshman seminar programs: Findings, conclusions, and recommendations. Columbia, SC: National Resource Center for The Freshman Year Experience, University of South Carolina.

Hilton, T.L., and Lee, V.E. (1988, September/October). "Student interest and persistence in science: Changes in the educational pipeline in the last decade," Journal of Higher Education, 59 (5), 510-526.

Keimig, R.T. (1983). Raising Academic Standards: A Guide to Learning Improvement. ASHE-ERIC Higher Education Report No. 4, Washington, D.C.: Association for the Study of Higher Education, ED 233 669.

Levitz, R., and Noel, L. (1989). "Connecting students to institutions: Keys to retention and success." In M.L. Upcraft, J.N. Gardner, and Associates, The freshman year experience: Helping students survive and succeed in college. San Francisco: Jossey-Bass, Publishers.

Light, R.J. (1992). The Harvard assessment seminars: Second report. Explorations with students and faculty about teaching, learning, and student life. Cambridge, MA: Harvard University.

Martin, D.C. and Blanc R. (In press). "Video-based Supplemental Instruction: A pathway to mastery and persistence." In D. C. Martin and D. R. Arendale (eds.)., Supplemental Instruction: Increasing student achievement and persistence. New Directions in Teaching and Learning. San Francisco: Jossey-Bass Publishers.

Martin, D.C., Arendale, D., and Associates. (1993). Supplemental Instruction: Improving First-year Student Success in High-risk Courses. (2nd ed.). Columbia, SC: National Resource Center for The Freshman Year Experience, University of South Carolina.

Martin, D.C., and Blanc, R.A. (1984). "Improving comprehension through reciprocal questioning," Life Long Learning, 7 (4), 29-31.

Martin, D.C., Blanc, R.A., DeBuhr, L., Alderman, H., Garland, M., and Lewis, C. (1983). Supplemental Instruction: A Model for Student Academic Support. Kansas City, MO: The University of Missouri and ACT National Center for the Advancement of Educational Practices, 1983.

Martin, D.C., and Blanc, R.A. (1981). "The Learning Center's Role in Retention: Integrating Student Support Services with Departmental Instruction." Journal of Developmental Education, 4, 2-4, 21-23.

Martin, D.C. (1980). "Learning centers in professional schools." K.V. Lauridsen, ed., New Directions for College Learning Assistance: Examining the Scope of Learning Centers, San Francisco: Jossey-Bass.

Martin, D.C., and others. (1977). The Learning Center: A Comprehensive Model for College and Universities. Kansas City, MO: University of Missouri, ERIC ED 162 294.

Maxwell, M. (1990). "Does Tutoring Help? A Look at the Literature." Review of Research in Developmental Education, 7 (4), 1-5.

Noel, L., Levitz, R., Saluri, D., and Associates. (1985). Increasing Student Retention: Effective Programs and Practices for Reducing the Dropout rate. San Francisco: Jossey-Bass, Inc.

Shlipak, A.M. (1988). Engineering and physics as cultural systems: Impressions of science students at Harvard/Radcliffe. Thesis submitted to the Harvard

University Department of Anthropology for the degree of Bachelor of Arts with Honors, March 26, 1988.

Somers, R.L. (1988). Causes of Marginal Performance by Developmental Students. Boone, NC: National Center for Developmental Education, Appalachian State University.

Spann, N.G. (1990, September). "Student retention: An interview with Vincent Tinto," Journal of Developmental Education, 14 (1), 18-20, 22, 24.

Stahl, N.A., Simpson, M.L., and Hayes, C.G. (1992, Fall). "Ten Recommendations from Research for Teaching High-risk College Students." Journal of Developmental Education, 16 (1), 2-4, 6, 8, 10.

Tinto, V. (1993). Leaving College: Rethinking the Causes and Cures of Student Attrition. (2nd ed.). Chicago: The University of Chicago Press.

Tobias, S. (1992, May/June). "Science education reform: What's wrong with the process?" Change, 24 (3), 13-19.

Tomlinson, L.M. (1989). Postsecondary developmental programs: A traditional agenda with new imperatives. ASHE-ERIC Higher Education Report No. 3. Washington, D.C.: Association for Study of Higher Education.

Upcraft, M.L.; Gardner, J.N.; and Associates. (1989). The freshman year experience: Helping students survive and succeed in college. San Francisco: Jossey-Bass Publishers.

Watkins, B.T. (1990, January 17). "Few poor students found to move from 2-year to 4-year institutions," The Chronicle of Higher Education, A35.

Weinstein, C.E., Johnson, K., Malloch, R., Ridley, S., and Schultz, P. (1988, September 30). "The high school-to-college transition," Innovation Abstracts, 10(21), 1-2.

Wolfe, R. (1990, Spring/Summer). "Professional development through peer interaction," The Journal of Professional Studies, 14 (1), 50-57.

Wolfe, R.F. (1987). "The Supplemental Instruction program: Developing learning and thinking skills," Journal of Reading, 31 (3), 228-232.

Woodard, P.G., Brown, D.U., and Suddick, D.E. (1991, December). "The learning assistance needs of adult transfer undergraduate and masters level students," College Student Journal, 25 (4), 496-498.